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ABSTRACT

This study investigated the effect of different gender and ability composition on students' behaviors, interactions, and learning outcomes during small cooperative group activities. The study involved Year 6 children (N=440) who were assigned to one of 12 four-person groups that were either gender-balanced or gender-imbalanced with different compositions of high, medium, and low ability students. The children worked in their groups on a set of social studies activities for one hour each time three times per week for six weeks. Each group was videotaped twice during the period, once in Week 3 and again in Week 6. The results showed, contrary to expectations, that the effect of different ability and gender compositions was minimal. As the members of each group had more time to work together they became more responsive to each other's needs and provided more help and assistance to each other so that all groups attained comparable learning gains. (Contains 23 references.) (Author/ND)

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Interactions of children in classroom-based workgroups

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Abstract

This study investigated the effect of different gender and ability composition on students' behaviours, interactions, and learning outcomes during small cooperative group activities. The study involved 440, Year 6 children who were assigned to one of 12, four-person groups that were either gender-balanced or gender-imbalanced with different compositions of high (H), medium (M), and low (L) ability students. The children worked in their groups on a set of social studies activities for one hour per day, three times per week for six weeks with each group being videotaped twice during the period, once in Week 3 (Time 1) and again in Week 6 (Time 2). The results showed, contrary to expectations, that the effect of different ability and gender compositions was minimal. As the members of each group had more time to work together they became more responsive to each other's needs and provided more help and assistance so that all groups attained comparable learning gains.

While a number of studies have examined the relationship between group structure, giving help and achievement in small groups, few have examined the effect of group ability and gender composition on interactions and achievement. In those that have, researchers have found that the mixture of ability determines the types of interactions that occur in groups (Bennett & Cass, 1988; Webb, 1985) and group composition in turn, affects group interaction and achievement.

Although research has shown that children of different ability levels (high, medium, low) all benefit from cooperative group work, low ability children learn significantly more in heterogeneous ability groups than in homogeneous groups and medium ability students learn significantly more in homogeneous groups than heterogeneous groups. High ability children, though, learn equally well in either homogeneous or heterogeneous groups. Furthermore, while it has been demonstrated that homogeneous groups perform as well as heterogeneous groups in mathematics and science, they clearly out perform the heterogeneous groups in reading (see Lou, Abrami, Spence, Poulsen, Chambers, and d'Apollonia, 1996).

While this differential performance in group ability composition cannot be fully explained, it is possible that there are several mediational mechanisms that provide plausible explanations. Low-ability children may benefit from heterogeneous groups because they can rely on the higher ability children to provide them with critical insights and constructive feedback as they work collaboratively together (Cohen, 1994; Webb, 1985). High-ability students, in turn, may be prepared to provide help and support because in adopting the role of the 'teacher' they are seen to have prestige and authority and this, in turn, may increase their self-esteem and produce more positive attitudes towards school (Allen, 1976; Goodlad & Hirst, 1990). Medium-ability students may not benefit from heterogeneous groups because they are neither the tutor nor the tutee and may be overlooked in the interaction (Webb, 1985, 1991).

Similarly, the gender composition of the groups also appears to affect group interactions (French & French, 1984; Lockheed, 1985; Swann & Graddol, 1988). The effects of small group gender composition on interactions and achievement in classroom settings was first investigated by Webb (1984). She found in groups where gender and ability were balanced (2 m, 2f, high-medium-low), the males and females had similar interaction patterns and nearly identical learning outcomes.

However, in gender imbalanced groups (i.e., 3m,1f or 3f,1m, similar ability levels), the females did not achieve as well as their male counterparts. In majority-male groups, the females tended to be ignored as males focused their attention on other males; in the majority-female groups, the females focused much of their attention on the males to whom they gave more help than they gave to other females. The assistance provided to the males, however, was rarely reciprocated.

The study reported here was designed to investigate the effect of gender and ability compositions on students' behaviours, interactions, and learning outcomes during small cooperative group activities. The general research questions the study sought to address were: What effect does group composition (ability and gender) have on students' cooperative behaviours during small group activities? Does the composition of the group affect students' interactions and learning outcomes?

Method

Participants

The study involved 440, Year 6 children who were assigned (on the basis of their performance on the ACER General Ability Test-F developed by de Lemos, 1982) to one of 12, four-person groups that were either gender-balanced or gender-imbalanced with different compositions of high (H), medium (M), and low (L) ability students (see Table 1).

Insert Table 1 about here

Training in group process

Before the study began the children participated in two initial training sessions designed to teach the small-group skills required to facilitate group cooperation. These included the skills of actively listening to a speaker; stating ideas freely and clearly; providing constructive criticism on ideas; and accepting responsibility for one's own behaviours. In addition, the children discussed the importance of sharing tasks fairly; taking turns; resolving disagreements democratically; and trying to

understand the other person's perspective and position. The children then used these skills to develop their own set of group rules for working together.

Following training, the students worked in their groups on a set of social studies activities (Queensland department of Education) for one hour per day, three times per week. The tasks were open-ended and required the children to search for information, share it with others in the group, and decide on how to integrate the different pieces of information into a 'common' group product. The participating teachers agreed to follow a prescribed lesson format of reviewing work covered previously, suggesting possible ideas or issues to consider, and providing cooperative group work opportunities (Peterson & Janicki, 1979). Once the children moved into their groups, the teachers monitored the children's work, provided help as needed, and encouraged the children to seek help from each other before requesting assistance from the teacher.

Procedure

The study continued for six weeks with each group being videotaped twice during this period, once in Week 3 (Time 1) and again in Week 6 (Time 2). Previous research has indicated that reactivity to the video camera is short-lived (Christensen & Hazzard, 1983; Kent, O'Leary, Deitz, & Diament, 1979) and this was certainly the case in the present study. Each group was videotaped for 13 minutes 20 seconds, which represented 40, five-second intervals of observational time for each student in their group.

Observation schedules were developed to gather information on student behaviour states (i.e., cooperation, non-cooperation, independence-working independently of the group but on-task, individual non-task)(based on a similar schedule developed by Sharan and Shachar, 1988) and their constructive interactions (i.e., solicited and unsolicited explanations, terminal responses, giving help). This latter schedule (adapted from a coding schedule used by Webb, 1985) was designed to identify the specific interactions used by the children in their groups that facilitated understanding and learning.

In addition, a questionnaire, based on Bloom's (1976) taxonomy of learning objectives was written to assess how the children were developing understandings and making links between the different social studies activities they undertook during

their group sessions. The questions ranged from those designed to tap basic recall of details or facts and were built from the stem *"What is...?"* Such as *"What is the name of an explorer you have learnt about recently?"* A more probing question would require the children to investigate and analyse different information to arrive at an answer or solution to the problem and would be built from the sample stem *"Examine the..."*. An example is *"Examine the different sailing routes from England to Australia and find the safest route"*. The purpose of this assessment was to determine if the children had learned to construct new meanings and gain a broader understanding of the social studies work unit as it related to present knowledge and understandings.

This questionnaire, using the same generic question stems (but different content) was administered twice, once prior to the start of the study (following an introductory social studies section to familiarize the children with the proposed unit of work) and again at the end. Children were assigned a learning outcome score of 1 to 6 which reflected the highest level at which they were able to respond correctly on this questionnaire.

Results and discussion

In order to determine if the groups representing the 12 conditions differed from each other on the 12 dependent variables at Time 1, a multivariate analysis of variance (MANOVA) was conducted on the results. A significant multivariate statistic, Hotellings $T^2 = 0.66$, $F(132,428) = 2.08$, $p<.001$, permitted an examination of the univariate results. Significant univariate effects were found for cooperation $F(11,428) = 5.11$, $p<.00$, Independence $F(11,428) = 6.30$, $p<.001$, and Nontask $F(11,428) = 2.48$, $p < .01$.

Planned orthogonal contrasts were used to test for differences between the conditions and Condition 1 (H-M-L, 2m/2f). This condition was chosen as the comparison condition as previous research (Johnson & Johnson, 1990; Webb, 1985) had shown that more group helping behaviour occurs in cooperative groups containing a mixture of high, medium, and low ability students than when other ability and gender combinations exist. The results showed clearly at Time 1 that there were significant differences between the students in six of the conditions in cooperation, independence and non-task behaviours (see Table 2). The children in the two-ability

level conditions exhibited less cooperative behaviour and showed more independent (working on-task away from the group) and non-task behaviours than their peers in the three-ability conditions.

Insert Table 2 about here

A second MANOVA which tested for differences between the conditions was conducted in Week 6 (final week). The multivariate statistic was significant, Hotellings $T^2 = 0.49$, $F(132,428) = 1.54$, $p<.001$, allowing for an examination of the univariate results. Six of the 12 dependent variables produced significant effects. They were cooperation $F(11,428) = 2.63$, $p<.01$, independence $F(11,428) = 2.44$, $p<.01$, unsolicited explanations $F(11,428) = 2.12$, $p < .05$, unsolicited terminal $F(11,428) = 1.89$, $p < .05$, solicited explanations $F(11,428) = 2.35$, $p < .01$, and solicited other help $F(11,428) = 2.67$, $p < .01$.

Planned orthogonal contrasts tested for differences between the conditions and Condition 1 on the behaviour states. Significant effects were found only for Condition 11 (H-L, 3m,1f) with cooperation (p=.005) and independence (p=.038). An examination of the coded video data on the children's behaviour states showed that they were exhibiting more attending behaviour (i.e., eye contact, leaning forward to listen to a speaker) and providing more assistance (i.e., sharing resources, pointing to information) than they had previously. Thus, while the children in the three ability level groups settled more readily into working together initially, those in the groups containing two ability levels also developed cooperative behaviours over the duration of the study.

Similarly, the results also demonstrated that there were changes in the children's interactions in many of the groups between the first and second observation. At Time 1, significant univariate effects were found for Unsolicited explanations $F(11,428) = 2.85$, $p < .01$, Unsolicited terminal $F(11,428) = 3.11$, $p < .001$, Unsolicited other help $F(11,428) = 1.92$, $p < .045$, and Solicited explanations $F(11,428) = 2.00$, $p < .045$. While there were no significant differences between Condition 1 and the other three-ability level groups (gender-imbalanced) at Time 1, there were significant differences between children in seven of the two-ability level

conditions (see Table 3). Children in these conditions gave fewer explanations and assistance to each other than their peers in the three-ability level groups. Furthermore, they provided more unelaborated responses (i.e., 'yes' or 'no') than their peers in the three-ability level conditions. However, by the second observation, only Conditions 7 (M-L,2m,2f), 8 (M-L, 3m,1f) and 9 (M-L, 1m,3f) remained significantly different from the comparison condition, Condition 1 (see Table 4).

Insert Tables 3 & 4 about here

It appeared as the children in the groups had more time to work together, they became more aware of each others needs. This was evident in their willingness to provide not only more elaborated help (explanations) when it was explicitly requested but, also, provide more elaborated help even when it was not specifically requested. In so doing, the children appeared to be 'tuned-in' to each other's implicit needs and were responding to them.

Although it is only possible to speculate why the children in the groups containing all three ability levels (H-M-L with different gender combinations) adjusted more readily to the small group situation than the children in the groups containing two-ability levels, one can argue that the former may be more representative of cooperative grouping practices which are based on high levels of equality and mutuality or 'connectedness' (Damon & Phelps, 1989). In contrast, the relationship in the two-ability level groups may have been more typical of a tutor-tutee dyad in which one half of the dyad is perceived as 'the expert' and adopts a role which is quite different from that of the other half. This is only speculative because collaborative relationships have been found to differ widely in their degree of mutuality and their potential for enhancing cognitive growth (Forman, 1989).

In a similar way, gender composition may also assist in understanding the experiences children have in groups. For example, Johnson, Johnson, Scott, and Ramole (1985) found that children working in mixed-gender groups were more likely to involve low-ability students in joint activities than those who worked in single gender groups. Likewise, Gabbert, Johnson, and Johnson (1986) found that high-, medium-, and low-ability children all benefited academically from participating in

gender balanced, mixed ability cooperative learning groups. Certainly, in the study reported here, the children in all conditions (irrespective of gender combination) quickly learned to synchronize and coordinate their activities to work effectively and provide help and assistance to others in their groups.

Finally, an analysis of variance (ANOVA) of the mean differences between the learning outcomes for the 12 conditions at Times 1 and 2 was significant, $F(11, 428) = 4.06$, $p < .001$. Posthoc comparisons showed there were significant differences between the learning mean difference score for Condition 1 ($M = 1.63$) and the learning mean difference scores for Conditions 5 ($M = 0.80$), 6 ($M = 1.0$), 11 ($M = 1.00$), and 12 ($M = 0.9$). However, while the results showed clearly that the children in Condition 1 (three-ability levels, gender-balanced) achieved greater learning gains than their peers in the two-ability level, gender-imbalanced groups, the quality of the gains recorded by the twelve conditions were educationally comparably (see Table 5). The responses generated by the children showed that they were constructing more creative solutions, thinking more logically about problems, and using more evaluative responses than they had previously. Similar results have been described by Gabbert et al. (1986) using different tasks based on Bloom's taxonomy of learning objectives.

The research reported here is limited by two constraints. First, the study was short-term with only three weeks between the data collection points. Second, there were only two data collection points so there was no opportunity to gauge behavioural interactions across the full duration that the group operated. Both these issues need to be addressed in future research.

In summary, the results showed, contrary to expectations, that the effect of different ability and gender compositions was minimal. As the members of each group had more time to work together they became more responsive to each other's needs, they developed more sophisticated and creative responses to their problem-solving activities, and they provided more elaborated responses and explanations to assist each other's learning. An examination of the learning gains obtained suggest that positive learning outcomes occurred in all children as a result of their group experiences.

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Table 1: Ability and gender compositions of the 12 conditions

Condition	Ability composition	Groups	Gender composition	
			Males	Females
1	High-medium-low	10	2	2
2	High-medium-low	10	3	1
3	High-medium-low	10	1	3
4	High-medium	10	2	2
5	High-medium	10	3	1
6	High-medium	10	1	3
7	Medium-low	10	2	2
8	medium-low	10	3	1
9	Medium-low	10	1	3
10	High-low	8	2	2
11	High-low	6	3	1
12	High-low	6	1	3

Table 2: Summary of the significant contrasts only ($p<.05$) for the Behaviour States between Condition 1 and Conditions 4,5,7,8,9 and 11 at Time 1.

	Conditions					
Variable	4	5	7	8	9	11
Cooperation	.001		.001	.021		.000
Independence	.000	.037				.000
Individual	.028	.003	.000	.005	.017	.000

Table 3: Summary of the significant contrasts only ($p<.05$) for the Interactions between Condition 1 and Conditions 5, 6, 7, 8, 9, 10 and 11 at Time 1.

	Conditions						
Variable	5	6	7	8	9	10	11
Unsolicited explanations			.003		.028	.007	
Unsolicited terminal	.005			.014			
Unsolicited other help		.031			.010		
Solicited explanations			.002		.000	.018	.011

Table 4: Summary of the significant contrasts only ($p<.05$) for the Interactions between Condition 1 and Conditions 7, 8 and 9 at Time 2.

	Conditions		
Variable	7	8	9
Unsolicited explanations	.013		.017
Unsolicited terminal		.005	
Solicited other help	.000	.039	.034
Solicited explanations	.028		.004

Table 5: Learning outcome gains for Conditions 1-12.

Conditions	Gain
1. H-M-L (2m, 2f)	1.6
2. H-M-L (3m, 1f)	1.1
3.H-M-L (1m, 3f)	1.1
4. H-M (2m, 2f)	1.1
5. H-M (3m, 1f)	0.8 *
6. H-M (3f, 1m)	1.0 *
7. M-L (2m, 2f)	1.4
8. M-L (3m, 1f)	1.2
9. M-L (1m, 3f)	1.4
10. H-L (2m, 2f)	1.3
11. H-L (3m, 1f)	1.0 *
12. H-L (1m, 3f)	0.9 *

* $p<.05$